DOCUMENT RESUME

ED 413 083 PS 025 940

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TITLE Maternal Education and Its Influences on Child Growth and Cognitive Development in Rural Guatemala.
PUB DATE 1997-04-00
NOTE 12p.; Paper presented at the Biennial Meeting of the Society for Research in Child Development (62nd, Washington, DC, April 3-6, 1997).
PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Child Development; Child Health; Child Rearing; Child Welfare; Cognitive Ability; *Cognitive Development; Cognitive Processes; *Educational Background; Educational Benefits; Educational Experience; Foreign Countries; Knowledge Level; *Mothers; Parent Child Relationship; *Parent Influence; Physical Health; Socioeconomic Status; Womens Education; Young Children
IDENTIFIERS Cognitive Competence; Cognitive Level; *Cognitive Research; *Guatemala

ABSTRACT

This study examined the contribution of maternal education to variations in child outcomes from birth to 7 years of age. The sample for this study consisted of 266 children and their mothers, drawn from four rural communities in eastern Guatemala, who had participated in a longitudinal nutritional supplementation study. Data were presented which showed the influence of mother's education and socioeconomic status on the incidence of respiratory illness in offspring, and the influence of mother's education and socioeconomic status on children's performance on cognitive tests. Mothers with 4 or more years of education had children with lower incidence of respiratory illness at ages 1, 3, and 4. These children also performed significantly better on a preschool battery administered at ages 5 and 7 than mothers with fewer years of education. These results add to the growing evidence of the strong positive association between mother's education and child outcomes in developing countries. The data strongly support the argument for investment in basic primary education for females in lower income countries; the spread of female education has tremendous potential as a public health intervention. Based on the results, it was concluded that policy makers should focus on increasing access to schools, reducing attrition, and targeting the most needy populations. (Author/SD)

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ED 413 083

Maternal Education and its influences on Child Growth and Cognitive Development in Rural Guatemala

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Poster presented at the Biennial Meetings of the society for Research in Child Development, April, 3-6, Washington DC

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ABSTRACT

The purpose of this study is to examine the contribution of maternal education to variations in child outcomes from birth to seven years of age. The sample for this study consisted of 266 children and their mothers drawn from four rural communities in eastern Guatemala. Mothers with four or more years of education had children with lower incidence of respiratory illness at ages 1, 3 and 4 and performed significantly better on a preschool battery administered at ages 5 and 7 than mothers with fewer years of education. These results add to the growing evidence of the strong positive association between mother's education and child outcomes in developing countries. The data strongly support the argument for investment in basic primary education for females in lower income countries.

INTRODUCTION

There is growing awareness of the limitations of expensive medical infrastructure like hospitals and clinics, to adequately serve large populations in rural areas of the developing world. This limitation has shifted public health efforts to the role of the family in producing positive child outcomes. Following Caldwell's (1979) seminal work in Nigeria where maternal education was found to be significantly related to lower rates of child mortality, maternal education has consistently been linked directly to positive child outcomes.

Higher levels of maternal education have been linked to decreased child mortality (Cochrane, O' Hara & Leslie, 1982) lower rates of illness, improved nutritional status, (Behrman & Wolfe, 1987; Victora, Huttly, Barros, Lombardi & Vaughn, 1992), higher rates of immunization (Streatfield, Singarimbun & Diamond, 1990) and improved cognitive outcomes in offspring (Levine, Levine, Richman, Tapia Uribe, Sunderland Correa & Miller, 1991). In every instance, this relationship has been observed after accounting for socioeconomic status variables. Thus, the spread of female education has tremendous potential as a public health intervention.

METHODS

Subjects

The sample for this study consisted of 266 children and their mothers who were participants in a longitudinal nutritional supplementation study conducted by the Institute of Nutrition Central America and Panama. This supplementation study was conducted between 1969 and 1977 in four Spanish speaking villages in rural eastern Guatemala.

Subjects of the original study included all children seven years or younger living in these villages, those who moved in, and those born, during the duration of the study. The sample for the analysis reported here, was restricted to children with complete data on mother's schooling, respiratory illness, cognitive performance and socioeconomic status.

Villages

The four villages from which this sample is drawn, had populations ranging from 800 to 1200 inhabitants and were located in a dry mountainous area northeast of Guatemala city. Agriculture was the major occupation in these villages where poverty and illiteracy were common and malnutrition was endemic. Median family income when the study began was $200 (+/- $ 50). Percentage of literacy for mothers in the four villages ranged from 25 to 40% and for fathers' literacy ranged from 38 to 60%. In 1967, less than 10% of the families had any source of water at their homes and no homes were equipped with electricity (Pollitt et al, 1993).

Measures

Independent variable

Maternal schooling: is defined as years of formal schooling in the mother (self reported) with a range of 0 to 6 years of education. The mean is 1.34 with a standard deviation of 1.39. Maternal schooling is referred to as Maeduc in all tables and is coded as Maeduc1 for mothers with 1-3 years of education and Maeduc2 for mothers with 4-6 years of education.

Data on maternal schooling was collected during the census interviews conducted and the mother herself was usually the informant.

Dependent variables

(1) Respiratory illness: defined as a proportion of the number of days ill to number of days at risk (in the village). Respiratory illness variables were calculated for each year from 0-48 months. Respiratory illness information was collected through retrospective interviews every two weeks for the duration of the study in the home by trained interviewers. Respiratory illness variables are referred to as resp1yr, resp2yr, resp3yr and resp4yr in table 1.

(2)*Cognitive development tests:* A Preschool Battery which consisted of 10 tests was administered annually to all children aged 36, 48, 60, 72 and 84 months. Twelve additional tests were administered annually to all children at 60, 72 and 84 months (for detailed description of tests see Appendix A). The tests assessed a variety of skills such as verbal reasoning, learning, memory and perceptual analytical skills, and Piagetian concepts (e.g. conservation). Several of these tests were adapted from preexisting standardized tests (e.g. the Stanford Binet, Wechsler Intelligence Scale for Children and the Wechsler Preschool and Primary Scale of Intelligence). Test retest stability coefficients between tests (0.0 to 0.95) and within tests (e.g. 0.09 to 0.81) were obtained. Mean inter-observer reliability was 0.95 or above on all tests. Validity of the

battery was established through correlations with village adults' judgments of brightness of particular children. Further, test performance was associated with age of entry into school and with school achievement (Gorman & Pollitt, 1993). Testing occurred within 1 month of the child's birthday and testing took place in adobe huts which were centrally located in the villages. Tests were administered by trained Guatemalan school teachers (Pollitt et al, 1993).

Covariate

House Quality: a rating based on type of construction, interior design, and condition of dwelling, was used as a measure of wealth of each household. This factor score had a test-retest reliability of 0.65, and was conceived of as one of the measures of socioeconomic status. House Quality is represented as House in all tables.

RESULTS

General Linear model regression analyses (proc GLM, SAS) was used in all analyses. In all analyses the dependent variables were regressed on the two categories of mother's education while controlling for the wealth status of the household. Of the total of 22 tests in the preschool battery administered at 36, 48, 60, 72 and 84 months, only those tests with significant results ($P < 0.05$) are presented in table 2.

Results in table 1 clearly indicate an inverse relationship between mothers' education and incidence of respiratory illness in her offspring after controlling for the wealth status of the family. Further, mothers with 4-6 years of education had children with lower incidence of respiratory illness when compared to mothers with 1-3 years of education. Children from wealthier families had lower incidence of respiratory illness in all the years examined.

Results in table 2 indicate a similar pattern of results. Mothers with 4-6 years of education had children who performed significantly better than children of mothers with 1-3 years of education.

Table 1

The influence of mother's education, and socioeconomic status on the incidence of respiratory illness in offspring

Respiratory illness	Maeduc 1	Maeduc 2	House	R^2
Resp1yr	- 0.054 ^	- 0.138 *	- 0.042 *	0.06
Resp2yr	- 0.061 ^	- 0.093 ^	- 0.038 *	0.04
Resp3yr	- 0.078 *	- 0.197 *	- 0.051 *	0.07
Resp4yr	- 0.038 ^	- 0.181 *	- 0.055 *	0.06

* $p < 0.05$ ^ $p < 0.10$

Table 2

The influence of mother's education and socioeconomic status on children's performance on cognitive tests

Tested at	Name of test	Maeduc 1	Maeduc 2	House	R^2
36 mths	knoxf36	0.22	0.70*	-0.12	0.09
48 mths	digit48	0.44	9.36*	-0.55	0.04
	knoxs48	0.59 ^	0.43	0.19	0.04
60 mths	area60	-0.21	0.78*	0.03	0.10
	comvar60	-10.1	295.9*	-37.0	0.05
	digit60	4.34*	14.4*	-1.32	0.07
	discr60	3.89^	11.1*	1.94^	0.07
	matter60	-0.00	0.83*	0.12*	0.11
	mem60	0.31	1.44^	0.29	0.05
	name60	1.73*	2.75	0.25	0.04
	recog60	1.67*	2.48	0.48	0.05
	sent60	4.51	17.7*	-1.33	0.03
72 mths	comp72	26.9	352.8*	64.6^	0.08
	digit72	-0.08	24.9*	-0.11	0.10
	emb72	0.63	3.26*	0.03	0.07
	knoxf72	0.42	4.72*	0.79^	0.11
	match72	0.03	1.84*	0.12	0.05
	memdes72	1.48	25.6*	3.45	0.10
	odd72	0.31	3.69*	-0.11	0.08
	recog 72	1.49*	4.86*	0.36	0.11
84 mths	comvar84	16.7*	51.6*	-6.51^	0.15
	discr84	-4.73	-22.0^	-0.85	0.10

* $p < 0.05$ ^ $p < 0.10$

DISCUSSION

The results presented in tables 1 & 2 add to the growing empirical evidence of the strong positive association between maternal education and child outcomes in developing countries. Further, the benefits of education were noted in those mothers who had attained a minimum of four years of formal education. In a related study of the same population, it was observed that three to four years of formal education were necessary to acquire and maintain literacy skills (Gorman & Pollitt, 1994). It may well be that in this population, the more educated mothers have acquired specific skills (e.g., numeracy, literacy) which allow them to be more effective parents. Ongoing research will help to clarify the pathways by which mother's education leads to more effective parenting and more optimal outcomes in children.

The data support an argument for investment in basic primary education for females in lower income countries. Policy makers should focus on increasing access to schools reducing attrition and targeting the most needy populations.

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